REMARKS

By this amendment, Applicants have not amended the claims. As a result, claims 1-3, 7-8, 10-11, 13-17, 20-21, 23-26, and 28-29 remain pending in this application. Reconsideration in view of the following remarks is respectfully requested.

Initially, Applicants thank the Examiner for his time and courtesy in conducting a telephone interview with Applicants' undersigned representative on 17 December 2008. During the interview, various aspects of the rejection of claim 1 as allegedly being unpatentable over Ryzhii in view of Sarukura were discussed. No exhibits were demonstrated during the interview, and no agreement was reached as a result of the interview. The substance of the interview is included in the following remarks.

In the Office Action, the Office rejects claims 1-3, 7-8, 10, 13-17, 20, 24-26, and 29 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Ryzhii et al., "Terahertz photomixing in quantum well structures", J. App. Phys., Vol. 91, No. 4, pp. 1875-1881, 2002 (Ryzhii) in view of Sarukura et al., "Submilliwatt, short-pulse, terahertz radiation from femtosecond-laser irradiated InAs in a magnetic field," Lasers and Electro-Optics, 1998 (Sarukura). Applicants traverse these rejections for the following reasons.

Initially, Applicants note that in rejecting the claims, the Office, *inter alia*, defines the level of ordinary skill as "extremely high", and alleges that "the [Supreme] Court might easily have said that... the person of ordinary skill is a person of extraordinary creativity." Office Action, p. 7, second paragraph (emphasis in original).

In support of its findings, the Office states that "[m]any prior art solutions in this field have won Nobel prizes", and lists several Nobel laureates and notes that there are "probably a half dozen more this writer has forgotten." Office Action, pp. 4-5. Applicants again note that

the presence of several Nobel laureates in a field, such as the semiconductor device industry, is largely irrelevant to a finding of the level of ordinary skill as provided by the MPEP and case law. For example, the MPEP states that "[t]he examiner must ascertain what would have been obvious to one of ordinary skill in the art at the time the invention was made, and not to the inventor, a judge, a layman, those skilled in remote arts, or to geniuses in the art at hand." MPEP, 2141.03, III; citing *Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 218 USPQ 865 (Fed. Cir. 1983), *cert. denied*, 464 U.S. 1043 (1984). To this extent, whether or not a Nobel prize is awarded in a given field is irrelevant to the level of ordinary skill of those individuals practicing in the given field.

The Office goes on to buttress its finding by citing various anecdotal evidence of the value of various solutions in the semiconductor industry. Office Action, pp. 5-6. Again, Applicants respectfully submit that the economic value of solutions in the semiconductor industry is largely irrelevant to a finding of the level of ordinary skill in the semiconductor industry. Applicants note that there is no direct correlation between economic value of the various advances and the level of thinking exhibited by an individual of ordinary skill in the semiconductor industry.

In response to Applicants' previous arguments, the Office notes that several Federal Circuit cases outline the five factors used in the rejection. Office Action, p. 23, fn 4. However, Applicants note that the Office apparently misinterprets Applicants' arguments. In particular, Applicants do not challenge the Office's use of the five factors. Rather, Applicants challenge whether, by citing the presence of Nobel Prize winners and the value of various solutions, the Office has provided sufficient support for a finding that the level of ordinary skill is that of "extraordinary creativity" and "unprecedented in the history of Man" as alleged by the Office.

Applicants respectfully submit that the Office's finding that the level of ordinary skill includes "extraordinary creativity" extends well beyond the support provided by the Office and is unduly high. Since the Office applied an unduly high level of ordinary skill in analyzing the claimed inventions, Applicants respectfully request withdrawal of the obvious rejections.

With respect to claim 1, Applicants submit that the Office fails, *inter alia*, to show that the proposed combination of Ryzhii and Sarukura teaches or suggests exciting a carrier gas by generating a laser pulse with a laser and shining the laser pulse directly onto a semiconducting device having a two-dimensional carrier gas as in claim 1.

In Ryzhii, photomixing of infrared signals is used to generate tunable terahertz radiation. Ryzhii, Abstract. In particular, a quantum well is excited by two infrared laser beams with different frequencies. Ryzhii, p. 1876, second column, last paragraph. The plasma oscillations excited by modulated infrared radiation (two laser beams with close photon energies) result in the electromagnetic radiation. Ryzhii, p. 1879, second column, last paragraph. The Office states that "[t]he difference between the prior art method disclosed by Ryzhii et al. and the method of claims 1-3, 7, and 24 is that, where claims 1-3, 7, and 24 require a step of generating a 1-10,000 femtosecond laser pulse with a laser, Ryzhii et al.'s method includes a step of shining two lasers with a difference frequency." Office Action, p. 8. Applicants note that the method of Ryzhii also differs from the method of claim 1 in that Ryzhii uses two laser beams, or continuous wave lasers, whereas the method of claim 1 uses a laser pulse generated by a laser.

In Sarukura, bulk InAs was placed 45 degrees to a magnetic field, and a laser parallel to the magnetic field delivered 70-fs pulses at 800 nm with an 80-MHz repetition rate with 1.5-W average power. Sarukura, paragraph 2, lines 1-12. In this configuration, the bulk InAs emitted broadband terahertz radiation. Sarukura, Fig. 2. Sarukura noted that the power of the terahertz

radiation was dependent on the magnetic field. Sarukura, paragraph 2, lines 13-17, 20-32; Fig. 1. Additionally, Sarukura noted that the ellipticity of the terahertz radiation varied for different magnetic fields. Sarukura, paragraph 2, lines 41-51; Fig. 3.

Initially, Applicants respectfully submit that the Office fails to show, *inter alia*, "that the substituted steps and their functions were known in the art" as required by section IIIB of the *Examination Guidelines* quoted in the Office Action. Office Action, p. 13. For example, the Office recognizes that Ryzhii fails to teach or suggest exciting a carrier gas by generating a laser pulse with a laser and shining the laser pulse directly onto a semiconducting device having a two-dimensional carrier gas as in claim 1. Office Action, p. 8. However, the Office alleges that Sarukura teaches "generating a series of 70 femtosecond laser pulses with a laser and shining the laser pulses onto a III-V target." Office Action, p. 12. Even if, *arguendo*, the Office's interpretation of Sarukura is accurate, Applicants note that Sarukura fails to teach or suggest exciting a carrier gas by generating a laser pulse with a laser and shining the laser pulse directly onto a semiconducting device having a two-dimensional carrier gas as in claim 1. In particular, Sarukura delivers 70-fs pulses onto bulk InAs, which does not include a two-dimensional carrier gas as does the semiconducting device of claim 1. To this extent, Sarukura cannot teach exciting such a carrier gas using a laser pulse as in claim 1. As a result, the Office fails to present a *prima facie* showing "that the substituted steps and their functions were known in the art" to support the rejection of claim 1 under 35 U.S.C. § 103.

Further, Applicants respectfully submit that the Office fails to show, *inter alia*, "that one of ordinary skill in the art could have substituted one known element for another, and the results of the substitution would have been predictable" as required by section IIIB of the *Examination*

Guidelines quoted in the Office Action. Office Action, p. 13. For example, the Office alleges that

> Sarukura et al. discloses that those of skill in the art were familiar with a method combining the step of generating a series of 70 femtosecond laser pulses with a laser with a method (producing a tunable THz source in the 0.5-3 THz region by shining a laser onto a II I-V semiconductor target) very similar to Ryzhii et al.'s method. From the similarities between Sarukura et al.'s method and Ryzhii et al.'s method, one of skill in the art would have been able to conclude that the step of generating a series of 70 femtosecond laser pulses with a laser could have substituted for the step of shining two lasers with a difference frequency of Ryzhii et al.'s method.

Office Action, pp. 13-14. Initially, Applicants note that Sarukura does not teach or suggest "producing a tunable THz source in the 0.5-3 THz region," to the extent that this implies an ability to adjust a frequency of the radiation (as the term is commonly used in the art), as alleged by the Office. To the contrary, Sarukura only discusses changes in the power of the radiation and ellipticity of the radiation with respect to different magnetic fields. To this extent, Sarukura does not teach or suggest adjusting a frequency of the radiation as in claim 1.

Further, the Office alleges that Sarukura's method is "very similar to Ryzhii et al.'s method." However, as discussed during the telephone interview, Applicants note that apart from the generation of THz radiation and use of an As-based emitter, little to nothing is similar between the methods disclosed in Ryzhii and Sarukura. For example, the differences include:

a. Sarukura uses a magnetic field, whereas Ryzhii does not use a magnetic field;

b. Ryzhii applies a voltage to a device, whereas Sarukura uses no voltage;

c. Ryzhii generates electromagnetic radiation by exciting plasma oscillations in a quantum well, whereas Sarukura relies on the non-linear properties of the InAs bulk material;

d. Ryzhii's device generates tunable narrow band terahertz radiation, whereas Sarukura's device generates broad band radiation.

e. Ryzhii uses a device that includes a two-dimensional carrier gas, whereas Sarukura's emitter includes no two-dimensional carrier gas;

f. Ryzhii uses two continuous wave laser beams with close photon energies, whereas Sarukura uses a series of pulses; and

g. Ryzhii's device comprises a GaAs or InGaAs quantum well channel, while Sarukura uses bulk InAs.

To this extent, Applicants respectfully submit that, without benefit of the hindsight of Applicants' disclosure, a person having ordinary skill in the art would not have looked to the teachings of Sarukura to modify Ryzhii as alleged by the Office. In particular, a person having ordinary skill in the art would not have any expectation that such a modification would result in an operable solution for generating and/or managing radiation.

For example, rather than merely substituting one known element for another as alleged by the Office, the Office is proposing to replace the two continuous wave lasers of Ryzhii with the series of laser pulses of Sarukura. Applicants note that such a substitution is not a substitution of two alternative elements, each of which performs the same function. To the contrary, the series of laser pulses of Sarukura is clearly distinct from the two continuous wave lasers of Ryzhii.

Further, the Office does not show any teachings in Sarukura, Ryzhii, or the related art that would lead one of ordinary skill in the art to expect that the series of laser pulses of Sarukura could replace the two continuous wave lasers of Ryzhii to produce a functional system. To the contrary, as discussed above, the numerous differences between the two approaches would teach away from such an expectation. Applicants submit that such numerous differences between the

approaches of Ryzhii and Sarukura make any result of the Office's proposed substitution unpredictable, without benefit of the hindsight of Applicants' disclosure.

Still further, the Office's proposed substitution of the series of laser pulses of Sarukura for the two continuous wave lasers of Ryzhii impacts the operation of another component of the Ryzhii system, namely, the quantum well structure. In particular, in Ryzhii, the quantum well structure generates electromagnetic radiation as a direct result of irradiation from the two continuous wave lasers. By proposing to replace the two continuous wave lasers with the series of laser pulses of Sarukura, the Office is substantially altering how the quantum well structure is irradiated. Applicants submit that such an alteration makes any result of the Office's proposed substitution unpredictable, without benefit of the hindsight of Applicants' disclosure.

During the telephone interview, the examiner cited MPEP 2143.02 for the proposition that 35 U.S.C. 103 "require[s] only that the combination of references be operational, in order to be 'reasonably' successful," and that 35 U.S.C. 103 does "not seem to require that the combination produce any particular result." Interview Summary, continuation of substance of interview.

MPEP 2143.02 cites four cases in support of the requirement that the Office show a reasonable expectation of success. In each case, elements known in the art for performing a particular function were combined to perform the same functions. In particular, in *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 71 S. Ct. 127 (1950), a store counter, a three-sided rack, and guide rails were combined to form a new counter. However, each element was old, and no element was shown to "perform any additional or different function in the combination than [it] perform[s] out of it." *Great Atlantic*, 340 U.S. at 152. In *Anderson's Black-Rock, Inc. v. Pavement Salvage Co.*, 396 U.S. 57, 90 S. Ct. 305

(1969), a radiant-heat burner was included in a paving machine to prevent a cold joint. However, such a radiant-heat burner was used in other applications in the art to soften asphalt, and operation of the heater was not dependent on other equipment in the machine. In *Sakraida v. AG Pro, Inc.*, 425 U.S. 273, 96 S. Ct. 1532 (1976), various known elements were combined into a new flush system. However, each element was "performing the same function it had been known to perform." *Sakraida*, 425 U.S. at 282. Finally, in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 127 S. Ct. 1727 (2007), an adjustable electronic pedal with a position sensor attached to a support member at a fixed pivot point. However, the prior art included both adjustable electronic pedals and sensors attached at fixed pivot points.

In stating that 35 U.S.C. 103 does "not seem to require that the combination produce any particular result," the Office appears to allege that an expectation of the particular result of the proposed combination is not required to be shown. Applicants respectfully disagree. To the contrary, MPEP 2143.02 requires that the results of a combination be "nothing more than predictable results to one of ordinary skill in the art." MPEP 2143.02 (emphasis added). In each of the cited cases, the results were nothing more than the results that were found when the elements were used apart from the combination.

In the current case, the Office proposes to use the series of laser pulses in Sarukura to perform a new function, namely, exciting a carrier gas in a quantum well structure of Ryzhii. The Office fails to provide any showing in Ryzhii, Sarukura, or the related art that the series of laser pulses of Sarukura would be predicted to perform such a function. In particular, nothing in the prior art of record shows that the series of laser pulses of Sarukura had performed such a function when used apart from the Office's proposed combination.

Additionally, to the extent that the Office alleges that it is enough that the laser generating the series of laser pulses in Sarukura would continue to operate in the same manner in the Office's proposed combination, Applicants respectfully submit that this is insufficient to present a *prima facie* showing of obviousness. As discussed above, Applicants respectfully submit that the Office ignores the impact that the Office's proposed substitution will have on the operation of the quantum well structure of Ryzhii. In particular, by making the proposed substitution, the Office is substantially altering how the quantum well structure is irradiated. The Office has made no showing that Ryzhii, Sarukura, or any related art would lead one of ordinary skill to assume that such an alteration would result in predictable operation of the quantum well structure.

In light of the above, Applicants respectfully request withdrawal of the rejections of claim 1 and claims 2-3, 7, and 24, which depend therefrom, as allegedly being unpatentable over Ryzhii in view of Sarukura.

With respect to independent claims 8, 10, and 13-15, Applicants note that the Office presents similar arguments as those presented above with respect to claim 1 in each of these rejections. For reasons that should be clear from the discussion of the proposed combination of Ryzhii in view of Sarukura above, Applicants submit that the proposed combination of Ryzhii and Sarukura fails to teach or suggest all the features of claims 8, 10, and 13-15. As a result, Applicants respectfully request withdrawal of the rejections of claims 8, 10, and 13-15, and any dependent claims thereof, as allegedly being unpatentable over Ryzhii in view of Sarukura.

With further respect to claim 8, Applicants submit that the Office fails, *inter alia*, to show that the proposed combination of Ryzhii and Sarukura teaches or suggests adjusting a frequency of the radiation, which includes adjusting a gate length for the gate as in claim 8. In support of

its rejection, the Office cites a portion of Ryzhii that discusses the length of a quantum well channel. As illustrated in FIG. 1(b) of Ryzhii, the gate length is unrelated to the length of the quantum well channel. Applicants submit that Sarukura fails to address this deficiency of Ryzhii. As a result, Applicants again respectfully request withdrawal of the rejection of claim 8 as allegedly being unpatentable over Ryzhii in view of Sarukura.

With further respect to claim 16, Applicants submit that the Office fails, *inter alia*, to show that the proposed combination of Ryzhii and Sarukura teaches or suggests adjusting the frequency of the radiation by using a plurality of heterodimensional diodes as in claim 16. Applicants note that Ryzhii and Sarukura both fail to teach the use of a plurality of heterodimensional diodes, let alone using the plurality of heterodimensional diodes to adjust the frequency of the radiation as in claim 16. Further, the Office does not allege that either Ryzhii or Sarukura teaches such a feature. As a result, Applicants again respectfully request withdrawal of the rejection of claim 16 as allegedly being unpatentable over Ryzhii in view of Sarukura.

Further, the Office rejects claims 11, 21, and 28 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Ryzhii in view of Sarukura in further view of Peralta et al., "Terahertz photoconductivity and plasmon modes in double-quantum-well field-effect transistors", Appl. Phys. Lett., Vol. 81, No. 9, pp. 1627-1629, 2002 (Peralta). Applicants note that the Office presents similar arguments as those presented above with respect to claim 1 in each of these rejections with respect to Ryzhii and Sarukura and the Office's interpretations thereof. Applicants submit that Peralta fails to address the deficiencies of Ryzhii and Sarukura as discussed above. As a result, Applicants respectfully request withdrawal of the rejections of claims 11, 21, and 28 as allegedly being unpatentable over Ryzhii in view of Sarukura in further view of Peralta.

Applicants appreciate the Office's indication of allowable subject matter in claim 23.

Applicants note that the Office alleges that merely because Applicants did not argue a statement by the Office, Applicants "apparently agree with the Examiner's findings..." Office Action, p. 24. Applicants note that silence does not constitute or imply agreement, and respectfully request that the Office not read motives into Applicants' actions or inactions. To the contrary, as expressly stated in this and previous responses, Applicants reserve the right to challenge all of the Office's assertions.

Applicants submit that each of the pending claims is patentable for one or more additional unique features. To this extent, Applicants do not acquiesce to the Office's interpretation of the claimed subject matter or the references used in rejecting the claimed subject matter. Additionally, Applicants do not acquiesce to the Office's combinations and modifications of the various references or the motives cited for such combinations and modifications. These features and the appropriateness of the Office's combinations and modifications have not been separately addressed herein for brevity. However, Applicants reserve the right to present such arguments in a later response should one be necessary and/or in a related patent application, either of which may seek to obtain protection for claims of a potentially broader scope.

In light of the above, Applicants respectfully submit that all claims are in condition for allowance. Should the Examiner require anything further to place the application in better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the number listed below.

Respectfully submitted,

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Dated: 16 January 2009